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4 January 1995
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Regional Water Quality Control Board
2010 Iowa Avenue, Suite 100
Riverside, California 92507

Attention: Mr. Augustine Anijielo

SUBJECT: SYSTEM STARTUP AND PROGRESS REPORT FOR THE VAPOR EXTRACTION REMEDIATION PROJECT AT THE AMERICAN ELECTRONICS, INC. FACILITY LOCATED AT 1600 EAST VALENCIA DRIVE, FULLERTON, CALIFORNIA

Dear Mr. Anijielo:

This letter presents the vapor extraction system (VES) startup and progress report summarizing the remedial activities conducted from 13 October through 15 November 1994 for the vadose zone remediation project at the American Electronics, Inc. (AEI) facility, located at 1600 East Valencia Drive, Fullerton, California (site) (Figure 1). Previous investigations conducted at the site, which included soil-gas and soil matrix investigations, have indicated that the shallow soil beneath the southwest portion of the site is impacted by chlorinated hydrocarbons, primarily tetrachloroethene (PCE) and trichloroethene (TCE). During a 22 March 1994 meeting between representatives of AEI, Applied Geosciences Inc. (AGI), and the Regional Water Quality Control Board (RWQCB), the RWQCB indicated that the upper 15 feet of soil in the vicinity of borings BP-1, BP-5, and BP-6 would require remediation. It was agreed upon to address the impacted soil at the site by designing, installing, and operating a soil vapor extraction system (VES). A VES conceptual system design was presented in a 14 April 1994 letter addressed to American Electronics, Inc. and forwarded to the RWQCB for review (Applied Geosciences Inc., 1994). The RWQCB, in a letter dated 23 May 1994, approved the plan to install and operate the proposed system (RWQCB, 1994).

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Applied Geosciences Inc. has prepared this report to present an overview of the key aspects regarding the installation and operation of the vapor extraction system at the site. This work summarized in this report has been conducted in general accordance with the vapor extraction system conceptual design letter, dated 14 April 1994, at the request and authorization of Mr. Richard F. Holland of American Electronics, Inc.

OBJECTIVE

The objective of this report is to present an assessment of the progress of the VES startup and remedial progress.

APPROACH/SCOPE

The approach used to meet the objective included the following tasks.

- Assess the concentration of VOCs in the soil vapor stream that is removed by the VES;
- Monitor the flow rate of the extracted soil gas;
- Assess the total mass of VOCs being removed by the VES from the impacted area; and
- Evaluate the efficiency and monitor the operating parameters of the VCS.

VES SPECIFICATIONS

The vapor extraction system consists of one vapor extraction well (VEW) installed to a depth of approximately 15 feet BGS, a vacuum blower, a vapor control system (VCS) consisting of 3 carbon canisters connected in series, and three multi-depth soil-gas monitoring probes (SGPs) to measure vacuum response at various distances from the VEW. The VES was assembled and installed at the site during the period from June to October 1994. The boring logs, showing well construction details of the VEW and SGPs, are presented in Appendix A. A detailed schematic of the VES is presented in Figure 2. Prior to system startup, a permit to operate the VES was obtained from the South Coast Air Quality Management District (SCAQMD).

VES STARTUP ACTIVITIES

The VES startup and initial operations cover the period from 13 October through 15 November 1994 (approximately 34 days). The system operated continuously on a 24-hour-per-day basis, with the exception of three downtime periods. As a condition of the SCAQMD permit, the system was required to be shut down during the weekend hours of the first two weeks of operation because the facility is closed on the weekends and there was no one present to monitor

the system. The system was also shut down at the end of the startup period in order to regenerate the VCS carbon canisters. The system downtime periods are summarized in Table 1.

Monitoring of the system was conducted daily for the first two weeks of operation and once a week for the remaining two weeks. Monitoring activities consisted of collecting vacuum and flow rates measurements from the VES, sample collection from the influent vapor stream for chemical analysis, and measurements of the inlet and outlet vapor stream concentrations of the VCS carbon canisters using an Hnu photoionization organic vapor meter (OVM) to minimize breakthrough potential. In addition, vacuum measurements of the SGPs were collected periodically to assess the effective radius of influence of the system.

SYSTEM EVALUATION

Vapor Flow Rate

The initial flow rate from the extraction well was observed at approximately 15 standard cubic feet per minute (SCFM) at startup and increased steadily to a maximum of approximately 60 SCFM. It is common for the flow to increase as VOCs and soil moisture are removed from the subsurface resulting in an increase in the effective porosity of the soil and capacity for vapor transport. The average flow rate over the startup period was estimated to be approximately 49 SCFM. Based upon the recorded flow rates from the VEW it is estimated that approximately 1.83 million cubic feet of soil vapor were extracted from the subsurface soils during the startup period.

Laboratory Analysis of Vapor Samples

Vapor samples collected from the influent vapor stream for chemical analysis were submitted to Orange Coast Analytical of Tustin, California, a State-certified hazardous waste laboratory, and analyzed for volatile organic compounds (VOCs) in general accordance with U.S. Environmental Protection Agency (EPA) Method No. 8010.

The results of the laboratory analyses indicated that detectable concentrations of chlorinated hydrocarbons, namely tetrachloroethene (PCE) and trichloroethene (TCE), were present in the vapor stream extracted from the subsurface soils. The initial concentrations of PCE and TCE for the sample collected at system startup were reported at 640 and 570 micrograms per liter (μg/L), respectively. The concentrations were observed to decrease during the startup period and the concentrations of PCE and TCE for the final sample collected at the end of the startup period were reported at 39 and 55 μg/L, respectively. The results of the laboratory analyses are summarized in Table 2 and laboratory reports and chain-of-custody documents are presented in Appendix B. The laboratory results are visually illustrated in Graph 1, presented in Appendix C.

Mass Removal Rate

The daily mass of VOC removal was estimated by multiplying the linearly interpolated daily extraction flow rate by the linearly interpolated VOC concentrations of the soil gas samples as shown below:

$$M_{voc} = Q \times C_{voc} \times A$$

Where:

M_{voc}	=	Daily mass of VOC removal (pounds/day)
Q	=	Volumetric flow rate (cubic feet/day)
C_{voc}	=	VOC concentrations (micrograms per liter [µg/L])
A	=	Conversion Factor

The daily total VOC removal rate during the startup period was estimated to range from approximately 2.69 pounds to approximately 1.01 pounds at the end of the startup period, and the total mass of VOCs removed during the startup period was estimated at approximately 46 pounds. Based upon vapor stream monitoring before and after the VCS, it was estimated that the carbon canisters were saturated with VOCs after 30 days of operation, at which time the system was shut for carbon regeneration and subsequently restarted after regeneration of the canisters was completed. The estimated VOC mass removal is summarized in Table 3 and the cumulative mass removal over the course of the startup period is visually presented in Graph 2 (Appendix C).

Effective Radius of Influence

The effective radius of influence was estimated by plotting the log of the vacuum readings taken at the SGPs versus the distance from extraction well. The effective radius of influence is commonly defined as the extrapolated distance where the observed vacuum is equal to 0.1 inches H_2O. Vacuum measurements, collected during and after the startup period, were used for the estimation of the effective radius of influence and are presented in Table 4. The data from SGP1 and SGP2 were used for the estimations because they are on a linear trend with the VEW which reduces the possibility of spacial lithologic variations interfering with the estimation. The data from the 3 foot probe was left out of the estimation because the vacuum was observed to increase with distance from the VEW which would result in an infinite radius of influence. Prior to system startup, the targeted minimum radius of influence needed to influence the impacted soil areas was estimated to be approximately 50 feet. The estimated radius of influence derived from data collected during VES operation ranged from approximately 70 to 91 feet for the periods monitored. The data from SGP3, while not included in the interpolated estimation, still

provides the necessary information in that the measurements from the 7 and 12 foot probes were greater than 0.1 inches H_2O which indicates that the system is influencing the soil in the vicinity of well BP-5. The plots illustrating the estimated radius interpolations are presented in Graphs 3, 4, 5, and 6, and the radius estimations are shown in Figure 2.

DISCUSSION

The data collected during the startup period indicates that the VES is effectively removing VOCs from the subsurface soils at the site. The estimated radius of influence encompasses the target radius needed to influence the areas of impacted soil. Monitoring of the vapor stream before and after the vapor control system indicates that the vapor control system operates efficiently and stack emissions have met the conditions for vapor control system operation that were set forth in the SCAQMD Permit to Construct/Operate. It is estimated that approximately 46 pounds of VOCs have been removed from the subsurface during the startup period and the extracted vapor concentrations of total VOCs have decreased from 1,210 μg/L at startup to 94 μg/L after 34 days of operation, which is an approximate 92 percent reduction. The observed reduction in vapor concentrations suggests that the system may be reaching the point where the removal rate begins to approach asymptotic levels. Based upon these observations, it appears that the remediation efforts may be proceeding ahead of schedule and plans for confirmation sampling may be forwarded to the RWQCB in the near future.

CONCLUSION

Based upon information obtained during this report, current regulatory guidelines, and the judgment of Applied Geosciences Inc., the following conclusion is presented for your consideration:

- The vapor extraction system is effectively removing VOCs from the subsurface soils at the site.

RECOMMENDATION

Based on the data presented in this report and the professional judgement of Applied Geosciences Inc., the following recommendation is presented for your consideration:

- The vapor extraction system should continue to be operated as planned.

Should you have any questions, please feel free to contact us at your convenience.

Very truly yours,
APPLIED GEOSCIENCES INC.

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Assistant Project Hydrogeologist

MARK S. COUSINEAU, R.E.A.
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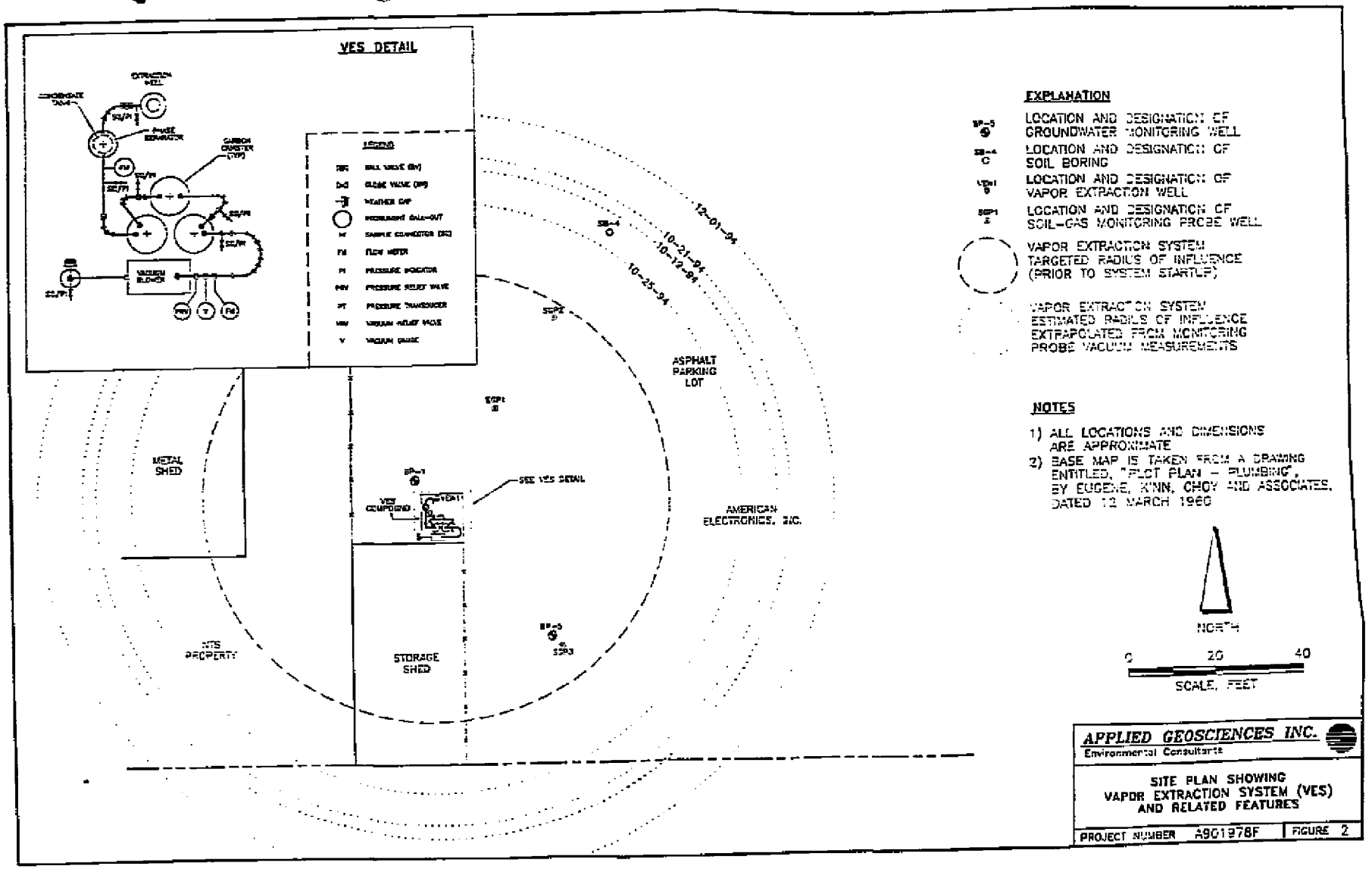
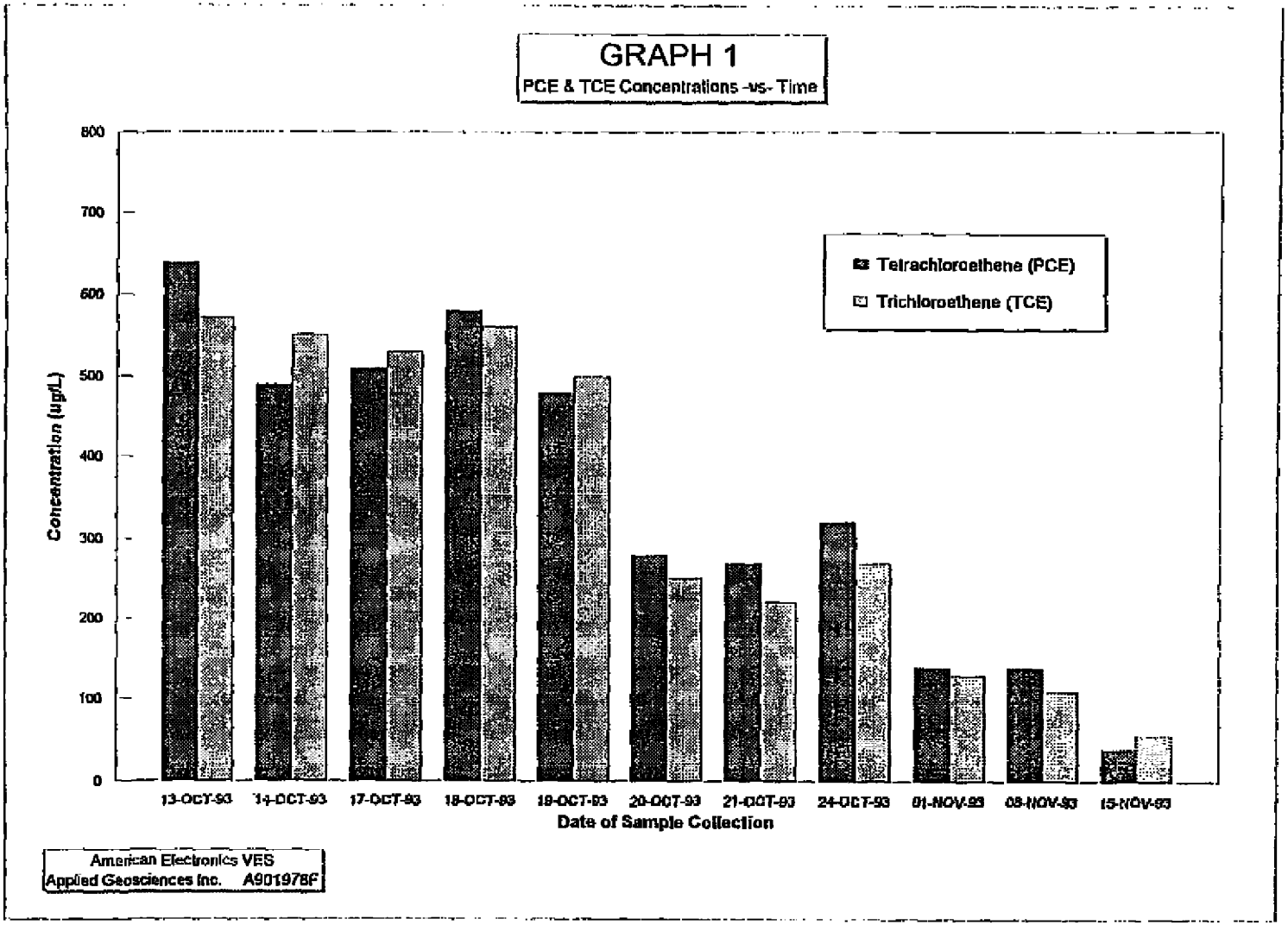
cc: Mr. Richard F. Holland, American Electronics, Inc.
Dave Peterson, Esq., Hill, Wynne, Troop & Meisinger

TABLE 2
ANALYTICAL RESULTS OF VAPOR SAMPLES

Sample Number	Date of Collection	EPA Method 8010 (ug/L)	
		PCE	TCE
AEI-IN1	13-OCT-93	640	570
AEI-IN2	14-OCT-93	490	550
AEI-IN3	17-OCT-93	510	530
AEI-IN4	18-OCT-93	580	560
AEI-IN5	19-OCT-93	480	500
AEI-IN6	20-OCT-93	280	250
AEI-IN7	21-OCT-93	270	220
AEI-IN8	24-OCT-93	320	270
AEI-IN9	01-NOV-93	140	130
AEI-IN10	08-NOV-93	140	110
AEI-IN11	15-NOV-93	39	55

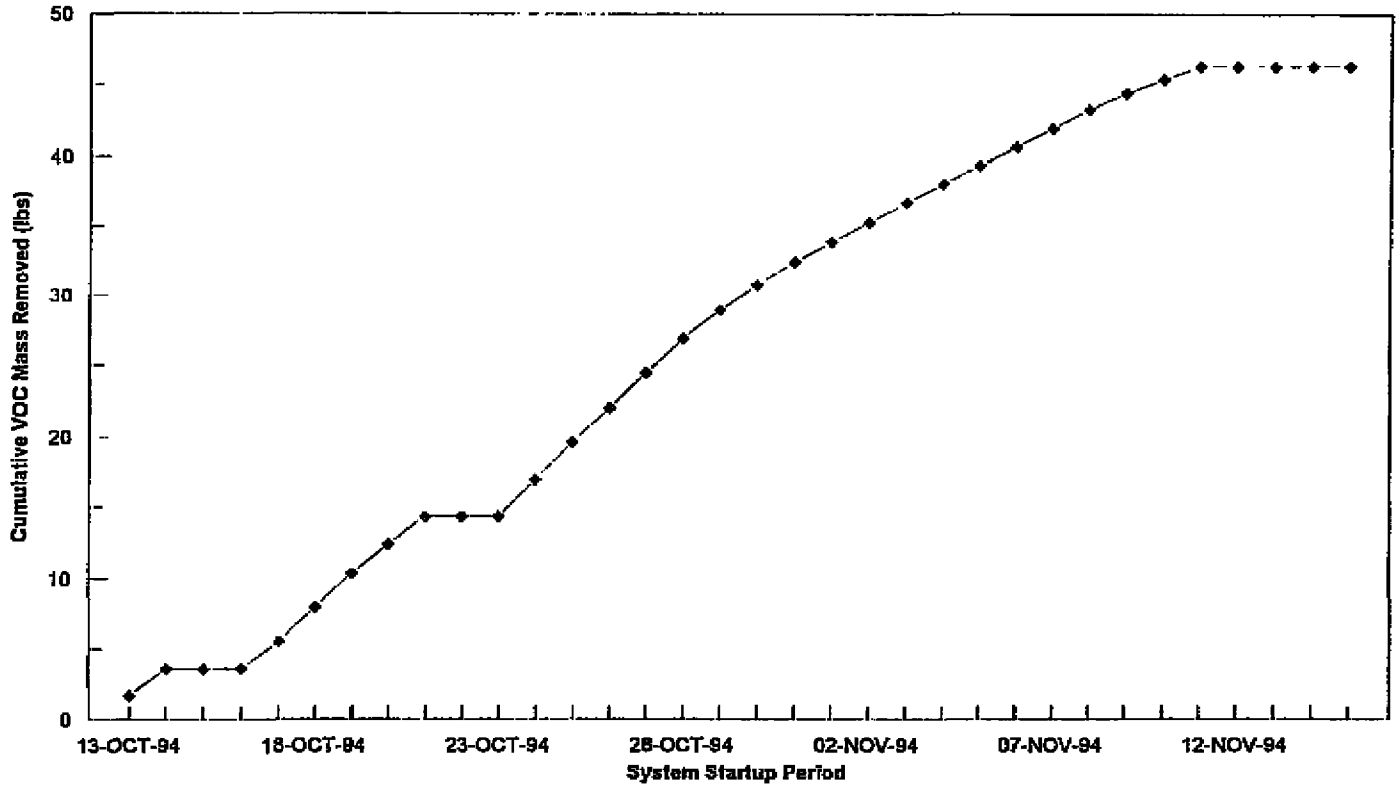
NOTES:
Vapor samples were analyzed for volatile organic compounds (VOCs) in general accordance with EPA Method No. 8010.
ug/L = micrograms per liter.
PCE = tetrachloroethene.
TCE = trichloroethene.





GRAPH 2

Estimated VES Performance (VOC Mass Removal)



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